# BRITISH PERMIAN SACCATE AND MONOSULCATE MIOSPORES

*by* R. F. A. CLARKE

ABSTRACT. Thirty-three species belonging to seventeen genera are recorded and described from the British Upper Permian (Zechstein). Six species are considered to be new. Three variants are described for *Lueckisporites virkkiae* Potonié and Klaus 1954 and the diagnosis is emended. The sample localities, brief lithological descriptions, and some spore frequencies are given together with a comparison of the present assemblages with those previously described from other parts of the world. It is concluded that a uniform flora existed throughout the Upper Permian in Great Britain and that this differed little from the Permian vegetation of Western Europe in general.

PREVIOUS work on the miospores of the British Permian is limited to a short publication by Chaloner and Clarke (1962) and the observations of Jansonius (1962). The aim of the present paper therefore is to describe the British Permian microfloral assemblages and to compare these with those previously described from other parts of the world.

*Slide collection and maceration technique.* The majority of the specimens illustrated in this paper are from single spore mounts. The method of making these and the preparation of the residues from the samples has already been described (Clarke 1965, this volume). The slide collection is housed in the Geological Survey and Museum, London.

*Classification and terminology.* The system used here to group spores into supra-generic categories is the 'Morphographic Classification' outlined by Potonié and Kremp (1954, 1955, 1956) coupled with subsequent additions (Potonié, 1956, 1958, 1960) and modifications set up by later authors. Some of the less obvious terms employed to describe the morphology of the different spore types are illustrated in text-fig. 1.

*Sample localities*

1. Hilton, Westmorland. The Hilton Plant Bed is exposed in Hilton Beck, 3 miles east-north-east of Appleby, Westmorland. The junction between the Penrith Sandstone and the Plant Beds is seen in the river bank on the north side at the western end of Ash Bank Wood. Most of the Plant Beds are exposed in the river bluff on the south side of the beck and consist of a series of well-bedded, alternating sandstones and thin pale-grey or olive-green shales (text-fig. 2).

2. Kimberley, Nottinghamshire. A 20-foot section of Lower Permian Marl (= Marl Slate of some authors) is exposed on the south side of the more northerly railway cutting (disused) some 500 yards west of the tunnel at Kimberley, west of Nottingham. At this point a 4-foot-thick Permian breccia overlies, unconformably, Carboniferous Coal Measure Sandstone. This is overlain by the alternating sandstones and shales of the Lower Permian Marl, containing ill-preserved plant remains. The top of the cutting exposes the Lower Magnesian Limestone, which here is arenaceous and gritty, obscuring a clear demarcation between this and the Lower Permian Marl (text-fig. 3).

3. Haughton Hall Boring. Located 4 miles south of East Retford, Nottinghamshire. All Permian samples examined between 987–1,117 feet contain spores.

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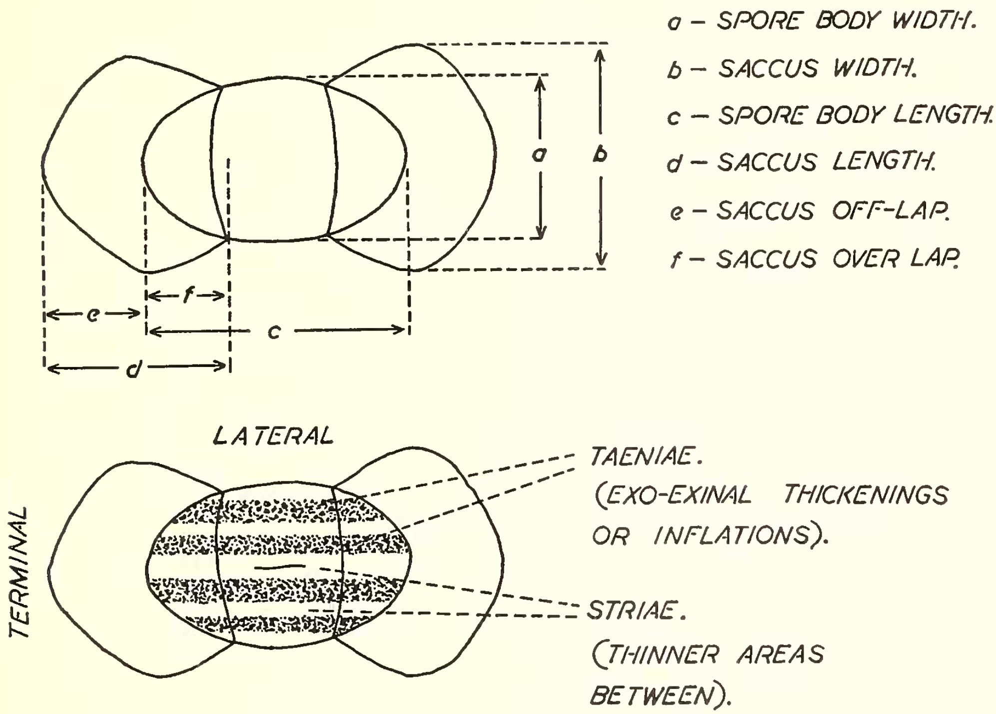
material and gave permission for the data to be published, and Mrs. H. H. Stoneley who supplied information on the Kimberley section is acknowledged with gratitude. To Dr. J. Jansonius I owe special thanks for allowing me complete freedom with the study of the Hilton Plant Beds after he had already started work on this section himself. The present paper formed part of a larger study of British Permo-Triassic spores, for a doctoral thesis, under the supervision of Dr. W. G. Chaloner to whom I am greatly indebted for immeasurable help and the critical reading of this manuscript. Finally I should like to thank the Department of Scientific and Industrial Research from whom I have been in receipt of a grant.




TEXT-FIG. 1. A generalized bisaccate miospore, in polar view, illustrating various terms used in this paper.

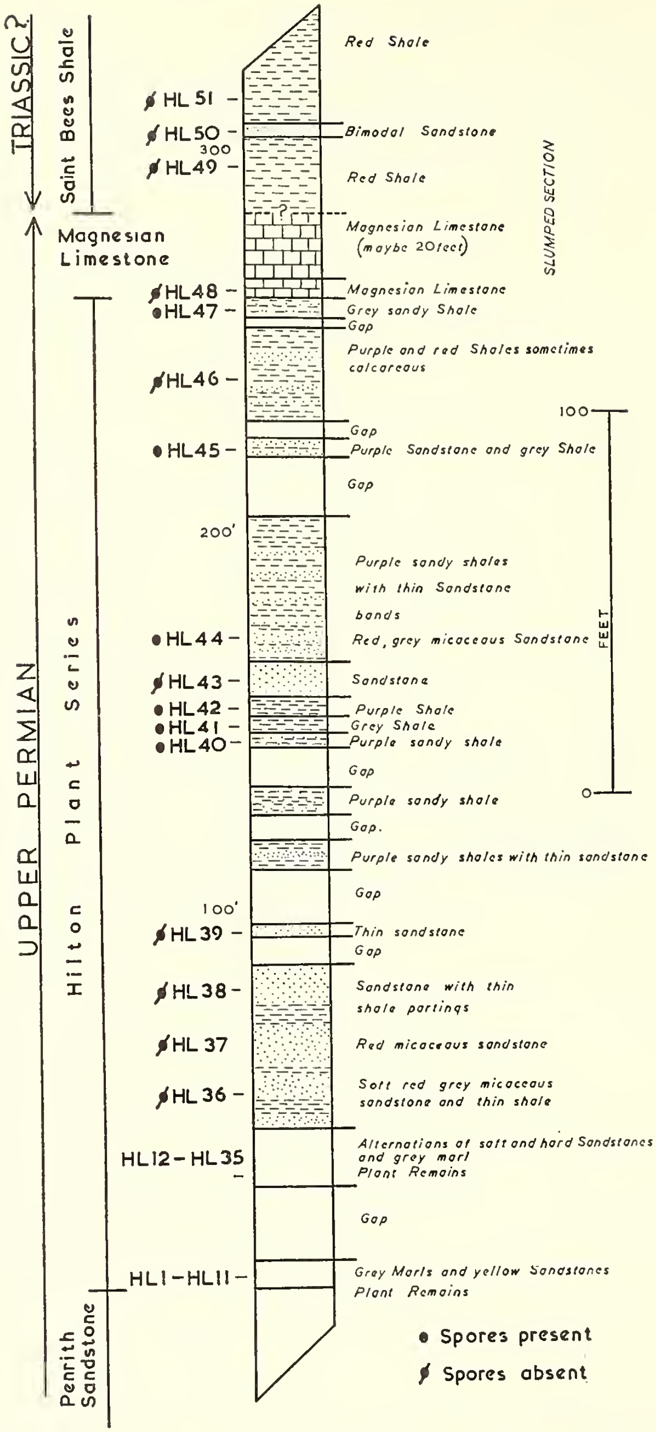
## SYSTEMATIC SECTION

Anteturma POLLENITES R. Potonié 1931
Turma SACCITES Erdtman 1947
Subturma MONOSACCITES (Chitaley 1951) Potonié and Klaus 1954
Infraturma VESICULOMONORADITES (Pant) Bhardwaj 1955
Genus POTONIEISPORITES Bhardwaj 1954

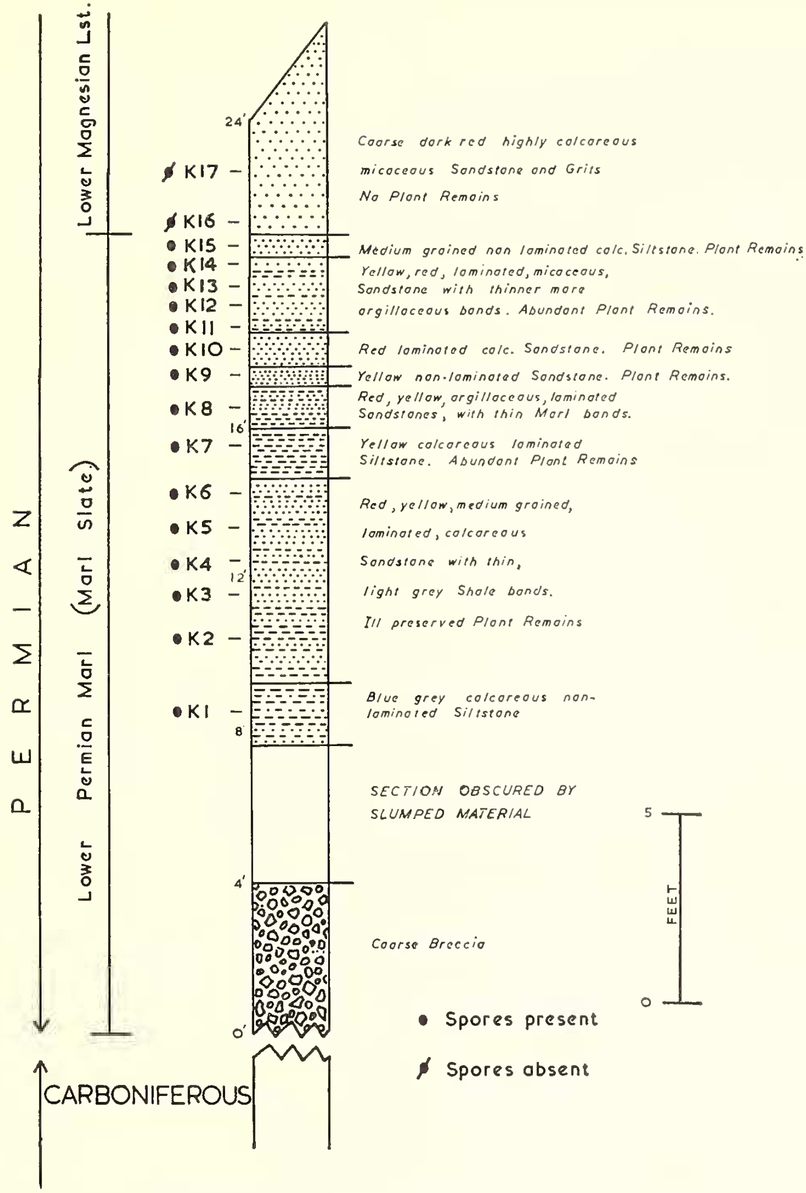
1962 *Hoffmeisterites* Wilson, pl. 3, fig. 4.

*Type species. P. novicus* Bhardwaj 1954.

*Discussion. P. novicus* and other species since assigned to the genus all show a series of folds which, broadly speaking, may be resolved into two separate sets. The first is



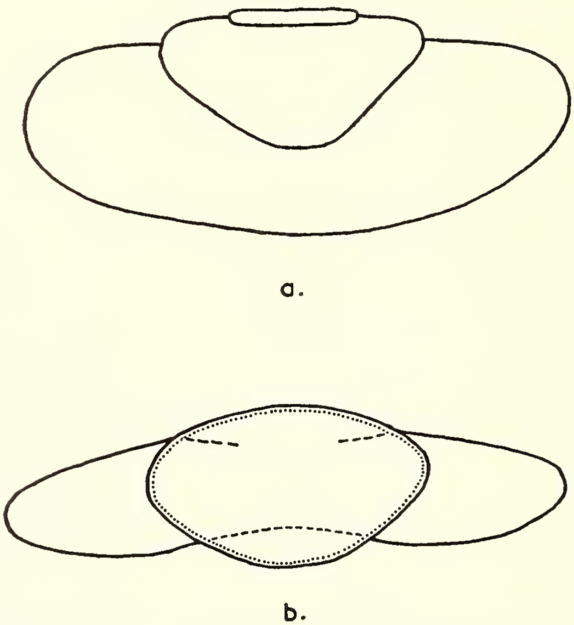

TEXT-FIG. 2. Stratigraphic section of the Upper Permian at Hilton Beck, Westmorland, showing the sample numbers and positions.




TEXT-FIG. 3. Stratigraphic section of the Upper Permian (Lower Permian Marl) at Kimberley, Nottinghamshire, showing the position and number of samples.

a set disposed along the inner margin of the spore body while the second set is situated closer to the polar region and orientated perpendicular to the long axis of the grain. It is the interpretation of the position and function of these folds which has led to certain differences of opinion with respect to the reconstruction of the spore. Bhardwaj (1956) interprets both sets of folds as compression features and regards the saccus as being free (unattached) in the distal region (Bhardwaj 1956, text-fig. 11). A somewhat different view is taken by Potonié and Lele (1961) who suggest that both series of folds are situated distally and form part of a single set which more or less delimits the germinal area. From the present study I accept the latter view and believe that the saccus is attached in the region of these folds (text-fig. 4*b*).

*Comparison. Vestigisporites* Hart 1960 is a monosaccate, monolete genus which, in polar view, can appear similar to *Potonieisporites* (e.g. *V. methoris* Hart 1960). *Vestigisporites* differs, however, in the less well-developed saccus swelling laterally, which is




TEXT-FIG. 4. Diagrammatic reconstruction of *Potonieisporites* Bhardwaj, in lateral (equatorial view). *a*, The reconstruction of Bhardwaj (1956), showing the saccus unattached (free) over the distal surface. *b*, The present interpretation where the saccus is attached to the spore body in this region.

never as large as that terminally. *Florinites* Schopf, Wilson, and Bentall 1944 has a distal attachment of the saccus, which is free proximally, and also has a triradiate mark. The lateral constriction of the saccus and the characteristically thickened 'sulcus' is sufficient to distinguish *Sahnisporites* Bhardwaj 1954 from *Potonieisporites*.

### *Potonieisporites novicus* Bhardwaj 1954

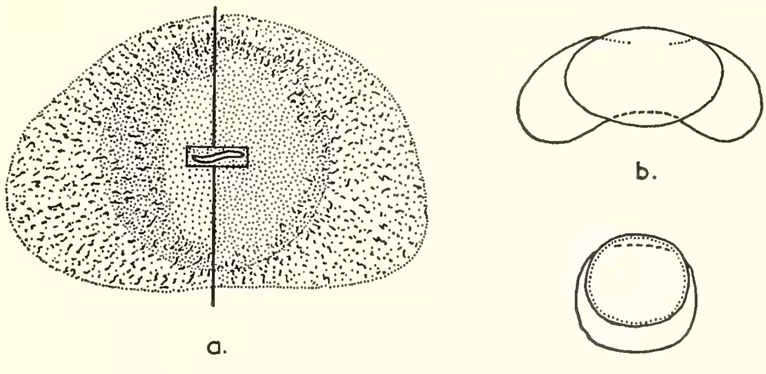
Plate 40, fig. 6, Plate 44, fig. 13; text-fig. 4

*Comparison. P. neglectus* Potonié and Lele 1961 differs from this species in the polygonal or trapezoid shape of the spore body and the smaller width of the saccus laterally. *P. simplex* Wilson 1962 is a smaller form in which lips are developed around the laesura (commissura of Wilson), while *P. bhardwaji* Remy and Remy 1961 appears to differ in its larger size, absence of a rim separating the saccus edge and the spore body, and a longer monolete mark.

### Genus VESTIGISPORITES Balme and Hennelly 1955 emend. Hart 1960

*Type species*. *V. rudis* Balme and Hennelly 1955.

*Comparison*. *Vestigisporites* differs from *Illinites* (Kosanke) Potonié and Klaus in being an essentially monosaccate genus with the bisaccate construction as the exception, and lacks the variation in the shape of the tetrad scar exhibited by *Illinites*.




TEXT-FIG. 5. *Vestigisporites minutus* sp. nov. *a*, × 1,000 (based on holotype). Polar view showing the monolete mark (in rectangle), the proximal surface on the right-hand side, and the distal surface with 'sulcus' on the left. *b*, Lateral polar section. *c*, Terminal polar section.

### *Vestigisporites minutus* sp. nov.

Plate 40, figs. 7–9; text-fig. 5

*Holotype*. Plate 40, fig. 7. Slide PF2196. Sample H 12, Hilton Beck, Near Appleby, Westmorland; Upper Permian.

*Diagnosis*. Small, bilateral, monosaccate miospores. Haploxylonoid. Spore body circular, rarely oval. Exine thin. Monolete. Terminal saccus swelling small compared with spore body; connected laterally by exoexinal strip. Saccus finely infra-reticulate. The saccus attachment distally leaves an elongated oval area free where the exine is thin.

*Description*. The grains are fossilized giving a preferred orientation flattened in the equatorial plane. The circular spore body is dark coloured and the monolete mark is short, often indistinct and sometimes open. In polar view the saccus completely surrounds the spore body but is not as wide laterally as terminally. One edge of the saccus appears to be attached equatorially and the other edge attached distally. The saccus offlap terminally (text-fig. 1) is slightly greater than the overlap on to the spore body.

*Dimensions*. (Thirty specimens.) Spore-body length 24(29)31$\mu$, spore-body width 28(32)35$\mu$, overall length 42(48)54$\mu$, overall width 32(35)40$\mu$.

*Comparison*. *V. minutus* sp. nov. is most similar to *V. hennellyi* Hart 1960 but differs in its very much smaller size and darker spore body. A reduction of the lateral saccus extension to give a bisaccate condition has not been observed for *V. minutus* sp. nov.; such a condition exists for *V. hemellyi* (Hart 1960, p. 15).

Infraturma TRILETESACCITI Leschik 1955

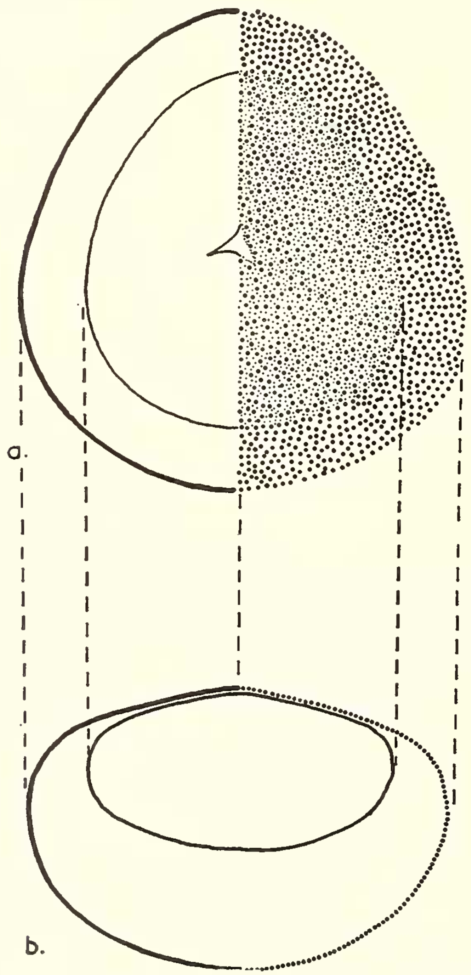
Genus PERISACCUS Naumova 1953 emend. Klaus 1963

1955 *Simplicesporites* Leschik.

*Type species. P. verruculatus* Naumova 1953.

*Discussion.* The genus *Perisaccus* is based on Russian Upper Devonian material and first appears as a *nomen nudum* in Naumova (1937); the genus is validated by Naumova (1953). The emendation of Potonié (1958) describes the spore as monosaccate, without a Y-mark and with an infra-reticulate saccus. A different aspect is given by the subsequent emendation of Klaus (1963) who ascribes to the genus a small Y-mark and a granular saccus sculpture.

Leschik (1955, 1956) describes and figures spores assigned to *Simplicesporites* Leschik which are almost certainly the same generically as those described by Klaus (1963) as *Perisaccus*. Leschik describes *Simplicesporites* as a 'zonate' genus and makes no reference to a Y-mark. However, the British material shows a development of secondary folds which cross the spore body margin without displacing it, and two independent superimposed sets of secondary folds can be seen within the area of the zona. These observations are consistent with a saccate rather than a zonate structure. Such features are clearly seen in Leschik's 1955 pl. 5, fig. 3. The inequality of the zona width described by Leschik for *S. virgatus*, &c., appears to be merely due to the difference in orientation of the grain when fossilized. The triradiate mark is always small and appears often as a triangular tear in the exine. Although not clearly demonstrable it appears that the saccus is attached proximally and is separated from the endexine distally (text-fig. 6).




TEXT-FIG. 6. Diagrammatic reconstructions of *Perisaccus granulosus* comb. nov., ×1,000. *a*, Polar view. *b*, Polar section, showing the relationship of the saccus to the spore body.

*Comparison. Perisaccus* differs from *Florinites* in the position of the saccus attachment, which is distal in the latter genus. *Endosporites* Wilson and Coe possesses a larger

Y-mark and a limbus which is not present in *Perisaccus*. *Remysporites* Butterworth and Williams 1958 differs also in the larger Y-mark, and its larger overall size. *Nuskoisporites* Potonié and Klaus has the saccus attached both proximally and distally. While Leschik's genera *Accinctisporites*, *Patinasporites*, *Zonalasporites*, and *Succinctisporites* are monosaccate, the attachment of the saccus is not discussed by that author and all are considered to be alete.

*Perisaccus granulosus* (Leschik 1955) comb. nov.

Plate 42, figs. 10–11; text-fig. 6

1955 *Simplicesporites granulosus* Leschik.
1963 *Perisaccus granulatus* Klaus, pl. 4, fig. 12.

*Description*. The central body, as seen in polar view, is circular or oval and darker coloured than the saccus. The spore body is smooth, the exine 1 $\mu$ thick and there is a small Y-mark, often in the form of a triradiate tear. The Y-mark is less than one-third the spore radius and often open. The saccus is attached to the spore body proximally; the distal surface remaining free. The saccus offlap (width) is less than half the spore body radius, and sculptured with closely packed isodiametric granules 1 $\mu$ in diameter.

*Dimensions*. (Twenty specimens.) Spore-body diameter 35(44)51 $\mu$, saccus width 6(9)13 $\mu$, overall diameter 54(62)72 $\mu$.

*Comparison*. *P. granulosus* comb. nov. differs from *P. pendens* (Leschik 1955) comb. nov., the latter having a triangular outline, although the spore body is circular. Other than this the two species are closely similar.

*Perisaccus laciniatus* (Leschik 1955) comb. nov.

Plate 42, fig. 12

*Comparison*. *P. laciniatus* comb. nov. differs from *P. virgatus* comb. nov. in the lack of spines attached to the granules, and from *P. granulosus* comb. nov. in the larger saccus.

Genus NUSKOISPORITES Potonié and Klaus 1954

1944 *Hymenozonotriletes* Mehta, pl. 1, fig. 1.
1951–2 *Hymenozonotriletes* Mehta; Goswami, pl. 13, fig. 11 (not fig. 10 as stated).
1951–2 (?) *Florinites sp*. Schopf, Wilson, and Bentall; Goswami, pl. 12, fig. 4.

*Type species*. *N. dulhuntyi* Potonié and Klaus.

*Discussion*. The diagnosis of Potonié and Klaus (1954) is written broadly around the type species; the genus at that time being monotypic. Some authors regard the presence of a limbus as an essential feature of the genus (Balme and Hennelly 1956*b*, Piérart 1959), while others (e.g. Potonié and Lele 1961) take a broader generic concept.

The saccus in *Nuskoisporites* is attached both proximally and distally leaving a non-cavate area over the proximal and distal poles where the exine (exoexine plus endexine) is thinner. The actual site of saccus attachment is seldom clearly shown and appears to be variable. It thus seems that *Nuskoisporites* may have functioned as a pollen with distal germination thus differing from a monosaccate microspore like *Endosporites*.

Separation of species is based primarily upon the length and form of the Y-mark, the saccus reticulum and the width of the saccus in relation to the spore body radius. Many authors (Virkki 1945, Potonié and Lele 1961, Høeg and Bose 1960) have remarked on the considerable variation within the species recognized.

*Nuskoisporites dulhuntyi* Potonié and Klaus 1954

Plate 40, figs. 1–2

*Discussion.* The cardinal characteristics of this species are the short Y-mark, the uniform width of this feature, and the presence of a limbus. *N. rotatus* Balme and Hennelly differs from the present species in the larger spore body, while *N. triangularis* (Mehta) Potonié and Lele 1961 possesses a larger Y-mark and lacks a limbus. *N. crenulatus* Wilson 1962 is a smaller form, without a limbus, and with a crenulate contact edge where the saccus overlaps the spore body. *N. radiatus* Hennelly 1958 lacks a limbus and has a finely infra-reticulate saccus.

*Nuskoisporites* cf. *rotatus* Balme and Hennelly 1956*b*

Plate 40, fig. 3

*Discussion.* The present specimens lack a limbus. Balme and Hennelly (1956*b*, p. 245) state that such a feature is only sometimes present and no mention of the limbus is made by Høeg and Bose (1960). *N. rotatus* is characterized by its small saccus width, long Y-mark, and the general absence of a limbus.

Infraturma STRIASACCITI Bhardwaj 1962 (= STRIATORNATI Jansonius 1962)
Genus CRUSTAESPORITES Leschik 1956 emend. Jansonius 1962

1955 *Lueckisporites* Potonié and Klaus; Balme and Hennelly, pl. 4, fig. 44.
1955 *Lueckisporites* Potonié and Klaus; Klaus, pl. 33, fig. 5.
1962 'Multistriate, monosaccate grain', Jizba, pl. 122, fig. 24.

*Type species. C. globosus* Leschik 1956.

*Discussion.* Leschik (1955) describes *Crustaesporites* as a trisaccate genus. Jansonius (1962), however, considers the trisaccate appearance to be the result of irregular constriction of a monosaccate miospore. The British material shows considerable variation

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EXPLANATION OF PLATE 40

Magnification ×750 unless otherwise stated.

Figs. 1–3. *Nuskoisporites spp.* 1–2, *N. dulhuntyi* Potonié and Klaus. 1, PF2189. 2, PF2190. 3. *N.* cf. *rotatus* Balme and Hennelly, PF2191.

Figs. 4–5. *Crustaesporites globosus* Leschik. 4, Trisaccate condition, PF2193. 5, Showing the development of four sacci; PF2194.

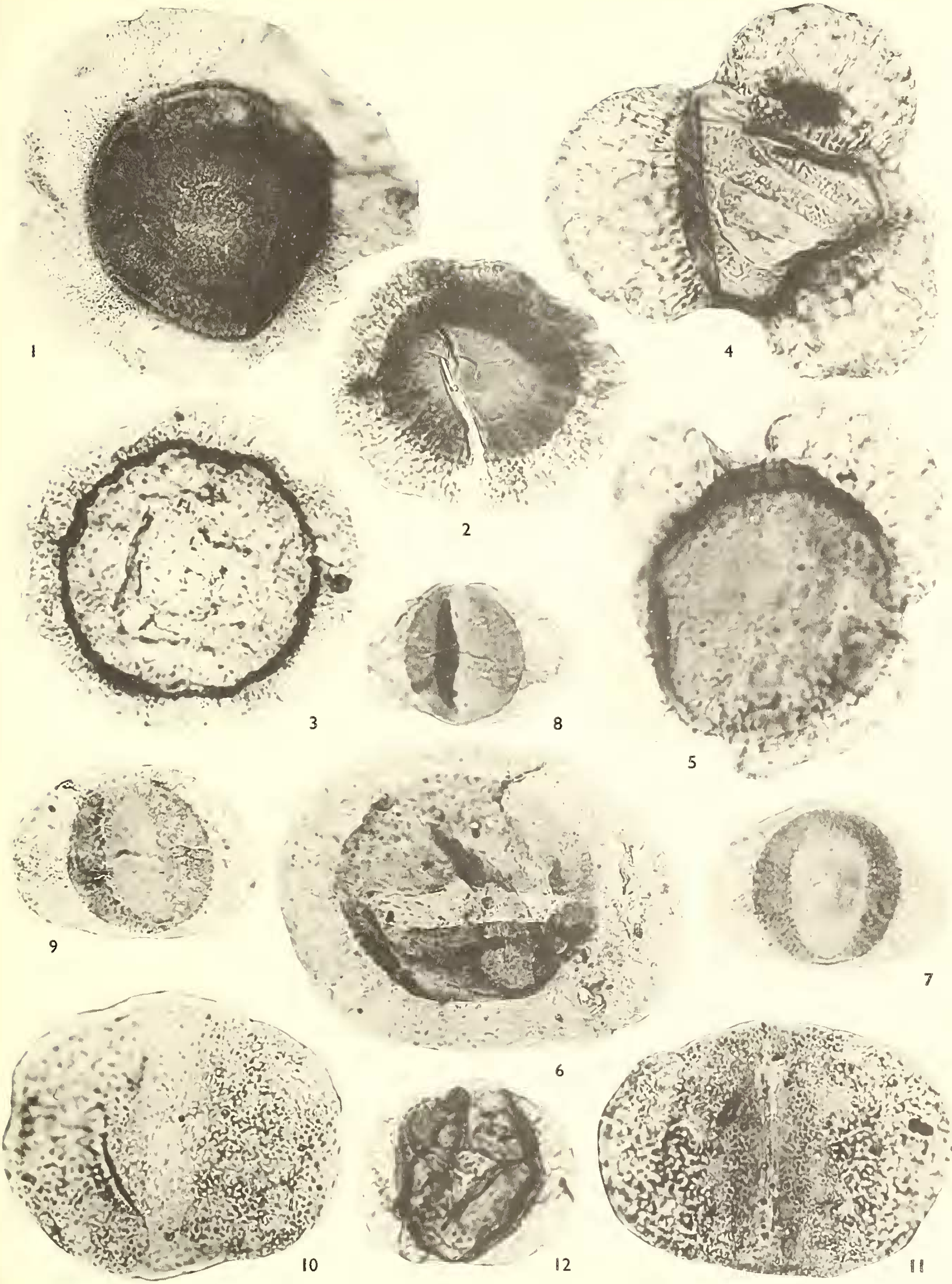
Fig. 6. *Potonieisporites novicus* Bhardwaj, ×500, PF2202.

Figs. 7–9. *Vestigisporites minutus* sp. nov. 7, Holotype, PF2196. 8, PF2197. 9, PF2198.

Figs. 10–11. *Falcisporites zapfei* Leschik. 10, PF2318. 11, PF2274.

Fig. 12. *Illinites klausi* sp. nov., holotype, PF2290.

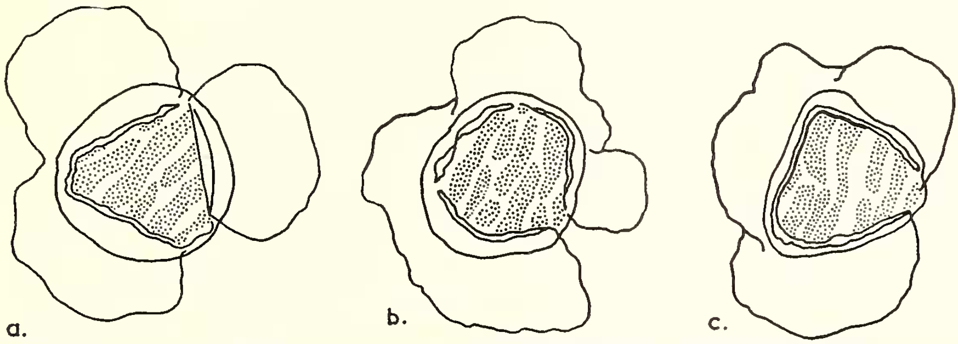
Localities of figs. 1–2, 4–6, 12, Lower Permian Marl, Kimberley. Figs. 7–11, Hilton Plant Bed. Fig. 3, Haughton Hall Boring, Lower Permian Marl, depth 1,095 feet.




CLARKE, Permian miospores

between a trisaccate condition and an irregular monosaccate structure (text-fig. 7, Pl. 40, figs. 4–5). While it is perhaps reasonable to consider the original structure as monosaccate, such irregularities of saccus structure have been demonstrated to occur as 'aberrants' of living bisaccate pollen (Van Campo-Duplan 1947, 1950, Van Campo-Duplan and Gaussen 1948, Martin 1961).

The frequency of occurrence of *Crustaesporites* in the present material is less than 1 in 2,000 and it is always associated with bisaccate striate genera. This association is maintained in all other localities from which *Crustaesporites* has been recorded (Europe,




TEXT-FIG. 7. Polar views of *Crustaesporites globosus* Leschik (drawn from specimens) illustrating variation in the outline of the saccus structure. *a*, More or less trisaccate condition. *b* and *c*, Irregular saccus.

Canada, Australia). In number of taeniae and saccus sculpture *Crustaesporites* resembles the bisaccate genus *Protohaploxypinus* most closely and probably represents aberrant spores of this genus. Nevertheless, I consider their recognition as a distinct genus an inevitable consequence of a morphographic treatment.

*Crustaesporites globosus* Leschik 1956

Plate 40, figs. 4–5

The variation in the shape of the saccus structure, encountered in the present material, is shown in text-fig. 7.

Subturma DISACCITES Cookson 1947
Infraturma STRIATITI Pant 1954
Genus LUECKISPORITES Potonié and Klaus 1954 emend. Klaus 1963

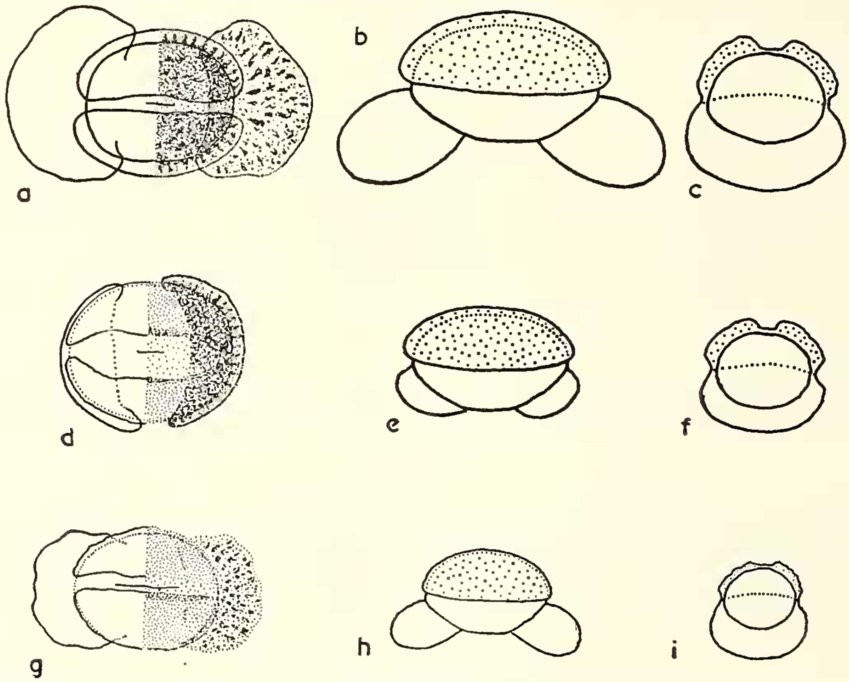
*Type species. L. virkkiae* Potonié and Klaus 1954.

*Lueckisporites virkkiae* (Potonié and Klaus 1954) emend.

Plate 43, figs. 3, 6–11; text-fig. 8

1960 *Lueckisporites nyakapendensis* Hart, pl. 1, fig. 12.

*Emended diagnosis.* Bilateral, bisaccate pollen grains. Sometimes haploxylonoid but typically diploxylonoid in overall outline. Spore body circular or oval where the length exceeds the width. Proximal face possesses a variable thickening (Kalotte of Potonié and Klaus) which is split by a laesura parallel to the long axis of the spore into two, more or less equal, halves. Sculpture is infrapunctate or infrabaculate. A monolete mark may be present. Sacci semicircular or more in outline, well developed and discrete. Sacci offlap may be considerable or non-existent. One saccus edge is attached at the equator; the attachment of the other being variable. Infra-sculpture of anastomosing muri forming a microreticulum or punctation; both types may show a radial pattern developed from the distal saccus roots. The exine is thin.




TEXT-FIG. 8. *Lueckisporites virkkiae* Potonié and Klaus emend. Diagrammatic reconstructions to show the differences between the variants A, B, and C. *a–c*, Variant A. *d–f*, Variant B. *g–i*, Variant C. *a*, *d*, *g*, Proximal polar views. *b*, *e*, *h*, Lateral views. *c*, *f*, *i*, Terminal polar sections.

*Discussion.* The British Permian has yielded many specimens referable generically to *Lueckisporites* s.str. There is a great variety of extreme forms connected by inter-

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EXPLANATION OF PLATE 41

Magnification ×750.

Figs. 1–3. *Protohaploxypinus spp*. 1–2, *P. jacobii* Hart. 1, PF2216. 2, PF2217. 3, *P. microcorpus* comb. nov., PF2218.

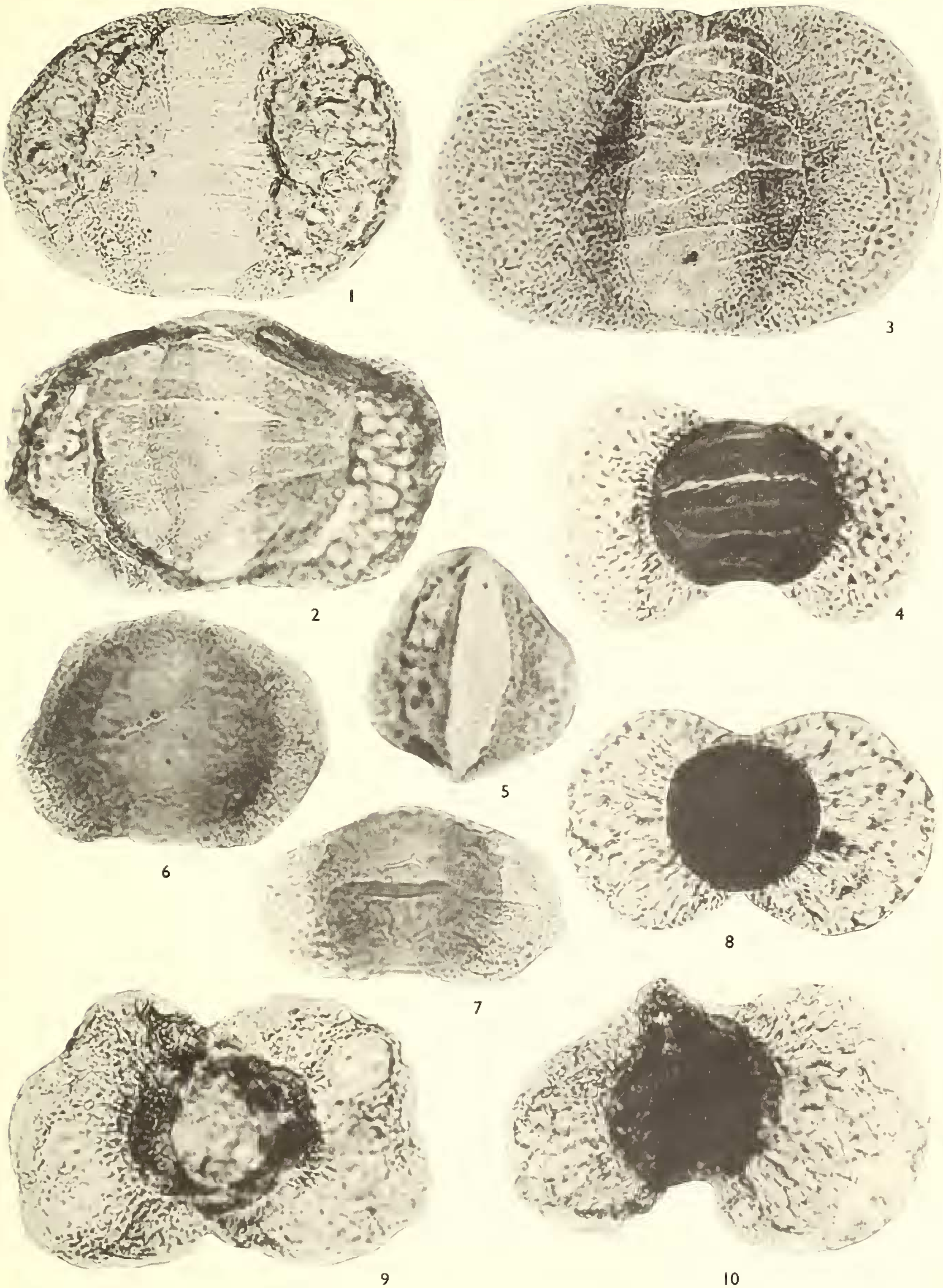
Figs. 4, 8. *Taeniaesporites spp*. 4, *T. nubilus* comb. nov., PF2226. 8, *T. bilobus* sp. nov., holotype, PF2221.

Fig. 5. *Labiisporites granulatus* Leschik, PF2272.

Figs. 6–7. *Illinites tectus* comb. nov. 6, PF2287. 7, PF2289.

Figs. 9–10. *Striatopodocarpites fusus* Potonié. 9, PF2222. 10, PF2223.

Localities of figs. 1, 2, 4, 8, 10, Lower Permian Marl, Kimberley. Figs. 3, 6, 7, Haughton Hall Boring, Lower Permian Marl, depth 1,095 feet. Figs. 5, 9, Hilton Plant Bed.




CLARKE, Permian miospores

mediates, making the separation of several species impossible. Potonié, who has seen the material here under discussion, agrees that the entire range can be included in *L. virkkiae* (personal communication 1962). For this reason it has been thought desirable to emend the specific diagnosis to include all these forms. Within the species three main extremes can be recognized and these are here referred to as variants A, B, and C (text-fig. 8). At no Permian horizon, so far studied, is one of the variants absent although there may be an assemblage shift in any of these directions. Variant A is characterized by the well-developed proximal thickenings, their distinct separation and well-developed sacci (Pl. 43, figs. 3, 8, 9). This variant is most similar to the holotype and *L. microgranulatus* Klaus 1963. Variant B differs in the less well-developed sacci and the negligible amount of offlap (Pl. 43, figs. 10–11). Variant B is similar to *L. parvus* Klaus 1963. Variant C is recognized by a weakly developed proximal cap and its incomplete separation into two halves and the generally smaller overall size (Pl. 43, figs. 6–7). *L. microgranulatus* (kleinere variante) Klaus 1963 is most similar to variant C.

### Genus TAENIAESPORITES Leschik emend. Klaus 1963

1954 *Lueckisporites* Potonié and Klaus (pars).
1955 *Lunatisporites* Leschik, pl. 7, figs. 21–24.
1955 *Succinctisporites* Leschik, pl. 7, figs. 4–5.
1956 *Jugasporites* Leschik (pars).
1958 *Pollenites* Pautsch, pl. 1, fig. 8.
1962 *Lueckisporites* Potonié and Klaus; Grebe and Schweitzer (pars).
1963 *Striatites* Pant; Schaarschmidt (pars).
1963 *Striatites* Pant; Klaus (pars).

*Type species. T. kraeuseli* Leschik 1955.

*Discussion.* While I accept the arguments of Klaus (1963) concerning previous uses and emendations of the genus and follow his emendation, I feel that the genus should be broadened to include all bisaccate miospores with four primary taeniae and which are haploxylonoid or diploxylonoid in outline, and not to restrict the genus to those forms showing a wide separation of the central taeniae. This is better considered a specific character.

*Comparison.* Taeniaesporites differs from *Lueckisporites* s.str. in possessing more than two taeniae, from *Protohaploxypinus* emend. Hart 1964 in having less than six primary taeniae, from *Striatopodocarpites* emend. Hart 1964 in the spore body to saccus ratio, and from Striatoabietites emend. Hart 1964 in the presence of fewer taeniae.

### *Taeniaesporites noviaulensis* Leschik 1956

Plate 42, figs 6–7

1962 *Taeniaesporites novimundi* Jansonius (pars), pl. 13, fig. 25 only.
1962 *Lueckisporites noviaulensis* Grebe and Schweitzer, pl. 5, fig. 7.
1963 *Striatites noviaulensis* Schaarschmidt, pl. 15, figs. 5–7, 9.
1963 *Taeniaesporites ortisei* Klaus, pl. 14, figs. 67–70.

*Comparison. T. noviaulensis* differs from *T. novimundi* Jansonius in the shape of the spore body, the larger sacci and the coarser infra-reticulum; and from *T. kraeuseli* in the shape of the spore body, form of the taeniae, and the shape and sculpture of the sacci.

### *Taeniaesporites novimundi* Jansonius 1962

Plate 44, figs. 1–2

The British specimens agree well with those described by Jansonius (1962) from the Permo-Triassic of Canada.

### *Taeniaesporites angulistriatus* (Klaus 1963) comb. nov.

Plate 44, figs. 11–12

1963 (May) *Striatites angulistriatus* Klaus, pl. 17, fig. 83.
1963 (August) *Striatites ovalis* Schaarschmidt, pl. 15, figs. 1–4.

*Discussion.* The most distinctive features of this species are the small size, the narrow distal area between the sacci attachments and the scabrate sculpture of both the taeniae and the sacci. *T. angulistriatus* comb. nov. differs from *T. kraeuseli* Leschik in the shape and sculpture of the sacci, and from other species in its taeniae and saccus sculpture.

### *Taeniaesporites albertae* Jansonius 1962

Plate 44, fig. 5

*Discussion.* This species is distinguished by its broad, slightly thickened taeniae, and the lack of radial alignment of the saccus sculpture. This species differs from *T. noviaulensis* Leschik and *T. novimundi* Jansonius in the broader taeniae, small sacci and the finer reticulum. *T. kraeuseli* differs in the more embracing sacci giving a narrow distal area.

### *Taeniaesporites labdacus* Klaus 1963

Plate 44, figs. 6–10; text-fig. 9

1954 *Lueckisporites sp.* Potonié and Klaus, pl. 10, fig. 2.
1962 *Lueckisporites noviaulensis* Grebe and Schweitzer, pl. 5, fig. 8 (*non* Leschik).

*Remarks.* This species is characterized by the presence of four taeniae of which the central pair are better developed than the lateral ones, and which may join terminally to form an elevated rectangular area around the proximal pole. A monolete mark is usually present, and thick muri form a coarse infra-reticulum on the sacci.

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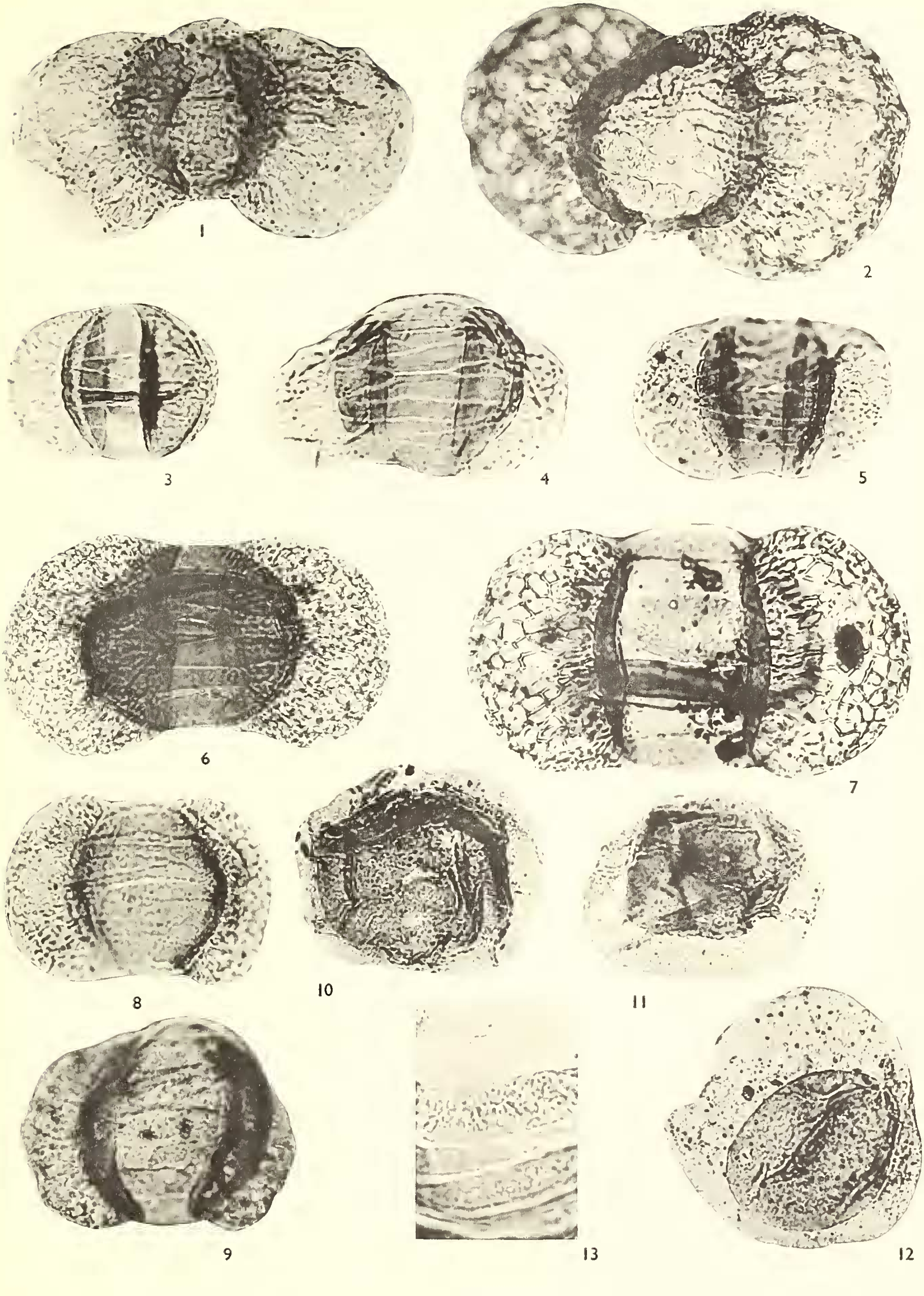
EXPLANATION OF PLATE 42

Magnifications ×750 unless otherwise stated.

Figs. 1–2. *Striatopodocarpites antiquus* Potonié. 1, PF2438. 2, PF2225.
Figs. 3–5. *Protohaploxypinus chaloneri* sp. nov. 3, PF2211. 4, Holotype, PF2210. 5, PF2212.
Figs. 6–7. *Taeniaesporites noviaulensis* Leschik. 6, PF2230. 7, PF2229.
Figs. 8–9. *Protohaploxypinus* cf. *samoilovichii* Hart. 8, PF2208. 9, PF2209.
Figs. 10–12. *Perisaccus spp.* 10–11, *P. granulosus* comb. nov. 10, PF2204. 11, PF2206. 12, *P. laciniatus* comb. nov., PF2483.
Fig. 13. *Taeniaesporites novimundi* Jansonius showing taeniae sculpture, ×1,500, PF2232.
Localities of figs. 1, 3, 4, 5, 10, 12, Hilton Plant Bed. Remainder from the Lower Permian Marl, Kimberley.

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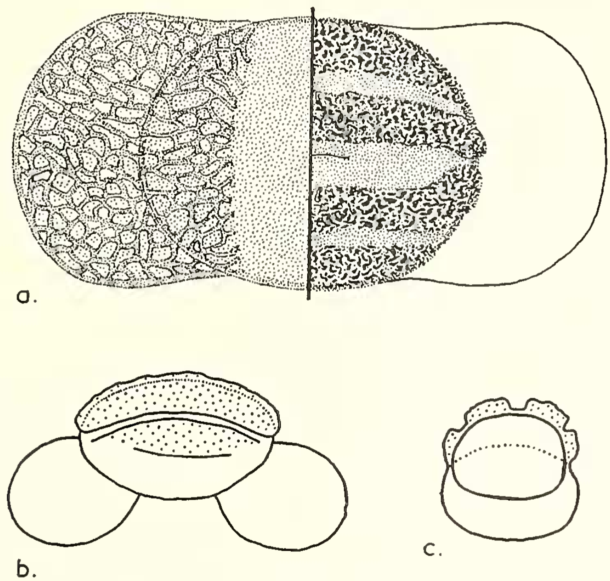
The variation shown by the present material makes it difficult to maintain the difference between this species and *T. alatus* Klaus 1963. The present forms are assigned to *T. labdacus* as this is the first of these two species described by Klaus (1963).




TEXT-FIG. 9. *Taeniaesporites labdacus* Klaus. *a*, Polar view showing the proximal face with the taeniae and monolete mark, on the right, and the distal face on the left (drawn from specimen), ×1,000. *b* and *c*, Diagrammatic reconstructions. *b*, Lateral view. *c*, Terminal polar section.

### *Taeniaesporites bilobus* sp. nov.

Plate 41, fig. 8; text-fig. 10

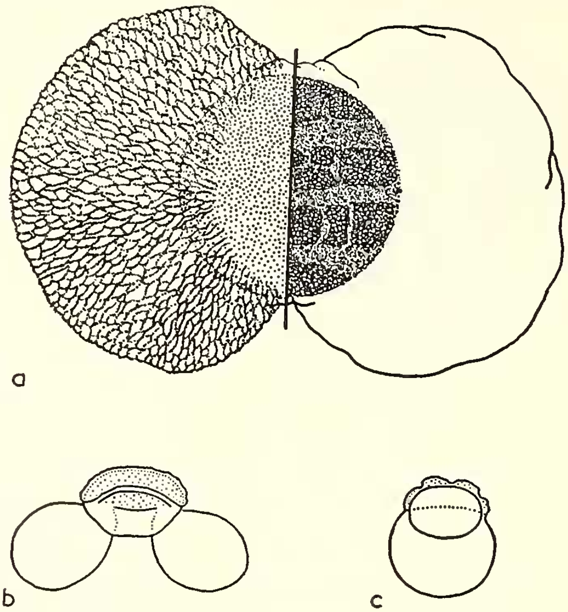
*Holotype*. Plate 41, fig. 8. Slide PF2221. Sample K 14, Kimberley, Nottinghamshire; Upper Permian (Lower Permian Marl).

*Diagnosis*. Spore body small, circular, dark coloured, and bearing up to five taeniae. Sacci relatively large and not connected laterally. The saccus sculpture is a medium infra-reticulum with a radial alignment from the saccus roots.

*Description*. The spore body proximal face is covered by taeniae, more or less parallel-sided, about 5$\mu$ wide, and separated by smooth striae. The taeniae are micropunctate and are frequently divided by transverse splits. A monolete mark is sometimes present. The saccus offlap greatly exceeds that of the overlap and the distal saccus attachment is indistinct; the saccus muri are 1–2$\mu$ thick.

*Dimensions*. (Seven specimens.) Spore-body length 27(29)32$\mu$, spore-body width 28(30)33$\mu$, overall length 60(68)79$\mu$.

*Comparison.* This species differs from other species of the genus in the comparatively larger sacci and the circular spore body.




TEXT-FIG. 10. *Taeniaesporites bilobus* sp. nov. *a*, Polar view showing the arrangement of the proximal taeniae, on the right, and the distal surface on the left (based on the holotype), ×1,000. *b*, and *c*, Diagrammatic reconstructions. *b*, Lateral view. *c*, Terminal polar section.

*Taeniaesporites nubilus* (Leschik 1956) comb. nov.

Plate 41, fig. 4

1956 *Jugasporites nubilus* Leschik, pl. 21, fig. 14.
1962 *Striatites? nubilus* Jansonius, pl. 14, fig. 20.
1963 *Striatites rarostriatus* Schaarschmidt, pl. 14, fig. 8.

*Discussion.* This species is characterized by its dumbell shape, thick spore body exine, and the coarse saccus infra-reticulum.

No mention of striations is made in the specific description of *Jugasporites nubilus* by Leschik (1956) but the illustration of the holotype gives the impression that this specimen is striate (see also Jansonius 1962). I accordingly assign it to *Taeniaesporites*.

*Comparison.* *T. nubilus* comb. nov. differs from *T. bilobus* sp. nov. in the more oval spore body and the thicker exine, and from the type species in the larger sacci.

Genus PROTOHAPLOXYPINUS Samoilovich emend. Hart 1964

1963 *Striatites* Pant emend. Klaus, pl. 17, figs. 79–82.
1963 *Striatites* Pant; Schaarschmidt, pl. 14, figs. 3–7, pl. 15, figs. 8*a*–8*b*.

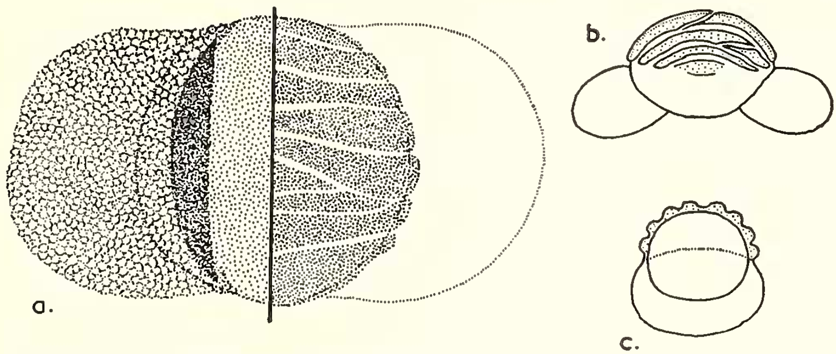
*Type species. P.* (al. *Pemphygaletes*) *latissimus* Luber and Waltz 1941.

*Comparison. Protohaploxypinus* emend. Hart (1964, p. 1171) differs from *Striatopodocarpites* emend. Hart in being more haploxylonoid and in the more variable form of the spore body. *Lueckisporites* s.str. and *Taeniaesporites* s.str. have fewer taeniae while *Complexisporites* Jizba differs from *Protohaploxypinus* in the presence of a groove surrounding a 'fissured' area on the proximal face. *Striatosaccites* Jizba differs from the present genus in having transverse sexinal strips distally while *Striapollenites* Bhardwaj 1962 has taeniae parallel with the transverse axis (i.e. perpendicular to all the above genera). *Striatoabietites* emend. Hart 1964 differs from *Protohaploxypinus* in showing a distinct angle where the saccus joins the spore body, as seen in polar view.

### *Protohaploxypinus jacobii* Jansonius emend. Hart 1964

Plate 41, figs. 1–2

*Remarks.* This species is similar to *P. sewardi* (Virkki) Hart 1964, differing only in its larger size, while *P. amplus* (Balme and Hennelly) Hart 1964 has a larger saccus offlap.




TEXT-FIG. 11. *Protohaploxypinus chaloneri* sp. nov. *a*, Showing the form of the proximal taeniae, on the right, and the distal surface on the left-hand side (based on the holotype), ×1,000. *b* and *c*, Diagrammatic reconstructions. *b*, Lateral view. *c*, Terminal polar section.

### *Protohaploxypinus* cf. *samoilovichii* (Jansonius) Hart 1964

Plate 42, figs. 8–9

1963 *Striatites samoilovichii* Jansonius; Schaarschmidt, pl. 14, figs. 3–5.

*Remarks.* The present forms are identical, except for their smaller size, with those spores described by Jansonius (1962) as *Striatites samoilovichii*.

*Dimensions.* (Twenty specimens.) Spore-body length 30(36)42$\mu$, spore-body width 36(41)48$\mu$, overall length 60(66)72$\mu$.

### *Protohaploxypinus chaloneri* sp. nov.

Plate 42, figs. 3–5; text-fig. 11

*Holotype.* Plate 42, fig. 4. Slide PF2210. Sample H 5, Hilton Plant Bed, Westmorland; Upper Permian.

*Diagnosis.* Spore-body amb circular or subcircular; proximal taeniae 10–12 in number, sometimes anastomosing or interrupted. Sacci well developed and semicircular in outline. Saccus infra-sculpture is a well-defined microreticulum without a radial pattern being developed. Sacci attachments distally show a crescent-shaped thickening which rarely extends to the equator.

*Description.* In the fossil state the pollen grains are invariably flattened in the equatorial plane and are therefore reconstructed from polar views. The spore body exine is 1–2$\mu$ thick and the taeniae are separated by narrow striae. A monolete mark is not evident although it is occasionally suggested either by the gaping of the more centrally placed taeniae or by an elongated secondary fold in this region. The sacci are discrete and the offlap is equal to the overlap, or somewhat greater. One edge of a saccus is equatorially attached while the other is attached distally, typically midway between the equator and the distal pole.

*Dimensions.* (Twenty-five specimens.) Spore-body length 30(36)42$\mu$, spore-body width 30(37)41$\mu$, overall length 48(57)63$\mu$.

*Comparison. P. minor* (Klaus 1963) comb. nov. is most similar to the present species, but differs in the shape of the sacci and the absence of the distal attachment thickenings.

*Protohaploxypinus microcorpus* (Schaarschmidt 1963) comb. nov.

Plate 41, fig. 3

1963 *Striatites jacobii* Jansonius; Klaus, pl. 17, fig. 79.
1963 *Striatites microcorpus* Schaarschmidt, pl. 14, figs. 6–7.

*Remarks.* This species, previously known from the Upper Permian of Germany and Austria, shows a large number of taeniae on the proximal face. The number can only be estimated at between ten and twenty, an accurate determination being precluded owing to their crowding and interruption.

Genus STRIATOPODOCARPITES Sedova emend. Hart 1964

1962 *Striatites* Pant; Jizba, pl. 122, figs. 25–30.

*Type species. S. tojmensis* Sedova 1956.

*Discussion.* The characteristic features of this genus are the distinctly diploxylonoid outline and the circular spore body with more than five proximal taeniae. The dark colour of the spore body observed in many species of *Striatopodocarpites* tends to

EXPLANATION OF PLATE 43

Magnification ×750 unless otherwise stated.

Figs. 1, 15. *Alisporites nuthallensis* sp. nov. 1, PF2232. 15, Holotype, PF2277.

Fig. 2. *Striatopodocarpites cancellatus* comb. nov., PF2252.

Figs. 3, 8, 9. *Lueckisporites virkkiae* Potonié and Klaus emend., Variant A. 3, Part of 'Kalotte', ×1,500, PF2256. 8, PF2319. 9, PF2257.

Figs. 4–5. *Striatoabietites richteri* Hart. 4, PF2491/720220. 5, PF2487.

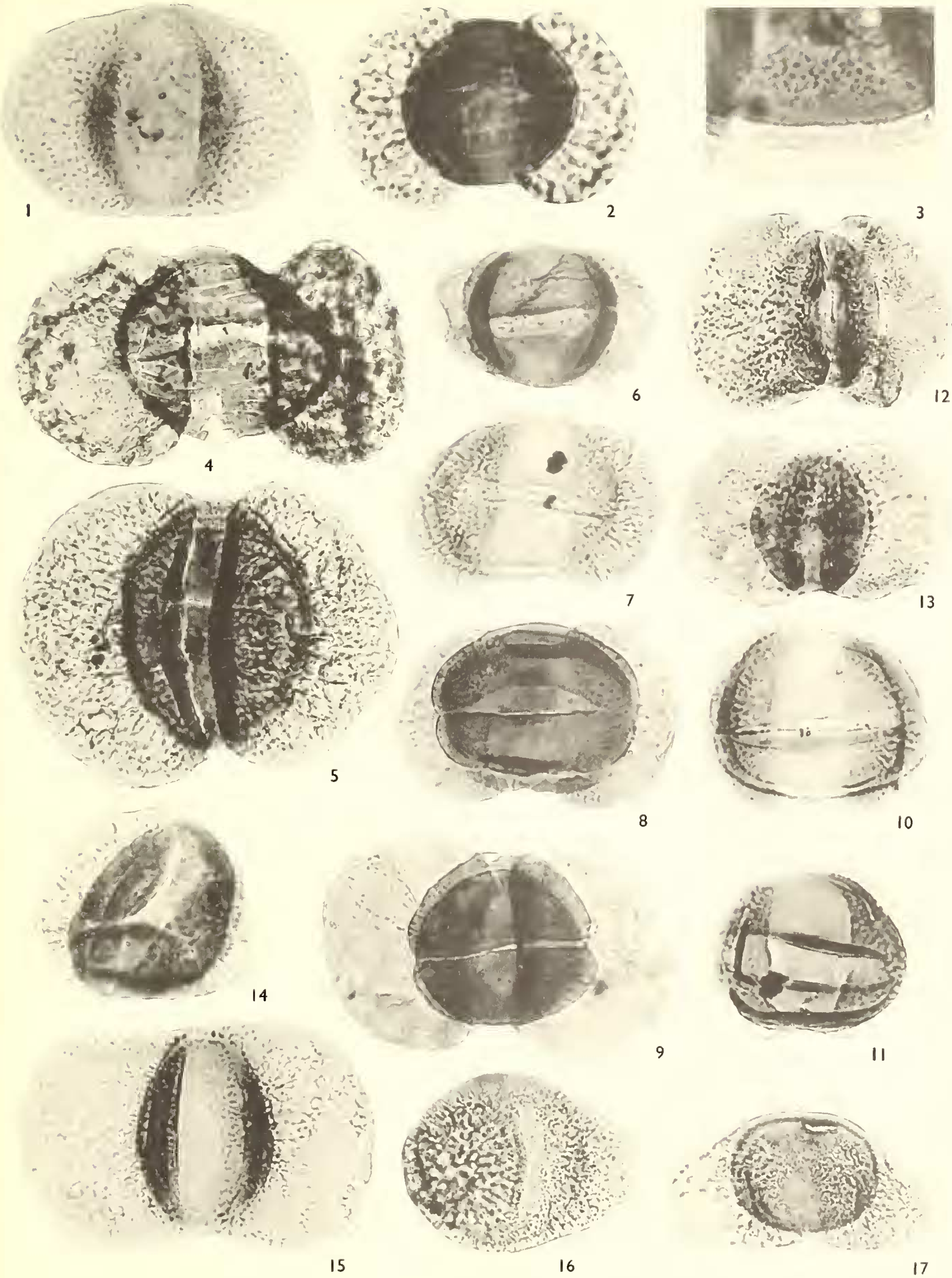
Figs. 6–7, 10–11. *L. virkkiae* emend. 6–7, Variant C. 6, PF2259. 7, PF2260. 10–11, Variant B. 10, PF2263. 11, PF2262.

Figs. 12–13. *Platysaccus radialis* comb. nov. 12, PF2486. 13, PF2485.

Fig. 14. *Illinites klausi* sp. nov., PF2291.

Figs. 16–17. *Klausipollenites schaubergeri* Jansonius. 16, PF2266. 17, PF2264.

Localities of figs. 1, 2, 5, 6, 7, 10, 11, 14–17, Lower Permian Marl, Kimberley. Figs. 3, 8, 9, 13, Hilton Plant Bed. Figs. 4, 12, Haughton Hall Boring, Lower Permian Marl, depth 1,095 feet.

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obscure the proximal surface features and it is felt that some species of this genus may have been wrongly assigned to *Platysaccus*. It appears that neither Naumova (1937) nor Potonié and Klaus (1954) consider *Platysaccus* as a striate genus, and on this account alone a separation from *Striatopodocarpites* seems meaningful. However, Jansonius (1962) assigns to *Platysaccus* cf. *papilionis* Potonié and Klaus 1954 forms said to have from two to four striations on the proximal face (p. 54 and pl. 12, fig. 19). I prefer to rate the presence or absence of striations as a generic character and to exclude all striate forms from *Platysaccus*.

*Comparison*. *Striatopodocarpites* differs from *Lueckisporites* s.str. and *Taeniaesporites* s.str. in the greater number of taeniae and the more distinctly diploxylonoid outline. *Rhizomaspora* Wilson 1962 is characterized by having radiating or diverging ribs on the spore body, and *Striatopodocarpites* differs from *Striatoabietites* emend. Hart 1964 in the more circular spore body and the comparatively larger sacci.

*Striatopodocarpites fusus* (Balme and Hennelly) Potonié 1958

Plate 41, figs. 9–10

*Discussion*. The cardinal characteristics of this species are the very large sacci, the multistriate spore body and the radially aligned reticulum of the sacci.

The taeniae, six to ten in number, are sometimes divided into irregular 'blocks' by small splits perpendicular to the long axis of the grain. The fine saccus infra-reticulum may be made to appear more coarse by corrosion (Pl. 41, fig. 10).

*Striatopodocarpites antiquus* (Leschik) Potonié 1958

Plate 42, figs. 1–2

*Remarks*. A common feature of this species is the small lateral union of the sacci making the pollen monosaccate. This also appears to be the case in the holotype. *S. antiquus* differs from the type species in the greater irregularity of the taeniae and from *S. phaleratus* (Balme and Hennelly) Hart 1964 in the absence of a distal groove bordered by lips. *S. balmei* Sukh Dev 1959 is distinguished by its wider taeniae and a coarser saccus reticulum.

*Striatopodocarpites cancellatus* (Balme and Hennelly) comb. nov.

Plate 43, fig. 2

1955 *Lueckisporites cancellatus* Balme and Hennelly, pl. 2, figs. 12–15.
1960 *Striatites cancellatus* (Balme and Hennelly) Hart, pl. 7, fig. 10.

*Remarks*. This species is characterized by the dark spore body, the presence of usually six taeniae and the fine saccus infra-reticulum.

Genus STRIATOABIETITES Sedova emend. Hart 1964

1962 *Illinites* Kosanke; Orlowska-Zwolinska (pars).
1963 *Striatites* Pant; Schaarschmidt (pars).
1963 *Strotersporites* Wilson; Klaus (pars).

*Type species*. *S. bricki* Sedova 1956.

*Discussion.* Although valid since 1956 this genus has not been widely used in Western palynological literature due mainly to the limited circulation of Sedova's (1956) publication. This 1956 publication must be regarded as effective although of limited circulation.

Spores assignable to *Striatoabietites* have been described by several authors under *Lueckisporites* and *Striatites. Striatoabietites* is characterized by the well-developed sacci which are generally equal in width, although smaller in length, than the striate spore body. The sacci form a distinct angle where they join the spore body, as seen in polar view.

*Comparison.* The present genus differs from *Striatopodocarpites* in the saccus to spore-body ratio and in being less distinctly diploxylonoid, while *Lueckisporites* s.str. and *Taeniaesporites* s.str. have fewer taeniae (i.e. less than six).

### *Striatoabietites richteri* (Klaus) Hart 1964

Plate 43, figs. 4–5

1955 *Lueckisporites richteri* Klaus, pl. 33, figs. 1–3.
1956 *Taeniaesporites richteri* Leschik, pl. 22, fig. 8.
1958 *Strialites richteri* Potonié, p. 51.
1962 *Illinites striatus* Orlowska-Zwolinska, pl. 3, fig. 3.
1963 *Striatites richteri* Potonié; Schaarschmidt, pl. 13, figs. 21–22; pl. 14, figs. 1–2.
1963 *Strotersporites jansonii* Klaus, pl. 15, figs. 74–75; pl. 16, fig. 78.
1963 *Strotersporites richteri* Klaus, pl. 15, figs. 76–77.

This species, recorded from many Western European and North American localities, is clearly circumscribed in the original description of Klaus (1955).

### Genus VITTATINA Luber 1940? ex Potonié 1958

1963 *Striatoluberae* Hart.

*Type species. V. subsaccata* Samoilovich 1953.

*Discussion.* This genus is attributed to Luber (1940) by Samoilovich (1953) who gives neither a type species nor a generic diagnosis but describes and figures three species of *Vittatina.* The relevant literature (i.e. Luber 1940) is not quoted in Samoilovich's bibliography. I have not seen this work of Luber, nor does it appear to have been seen by other authors subsequent to Samoilovich. The genus was thus invalid until Potonié (1958) gave a short diagnosis and named one species (*Vittatina subsaccata* Samoilovich 1953). Although this was not formally designated the type species by Potonié it may be

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EXPLANATION OF PLATE 44

Magnification ×750 unless otherwise stated.

Figs. 1–2, 5–12. *Taeniaesporites spp.* 1–2, *T. novimundi* Jansonius. 1, PF2234. 2, PF2235. 5, *T. albertae* Jansonius, PF2243. 6–10. *T. labdacus* Klaus. 6, PF2240. 7, PF2244. 8, PF2238. 9, PF2237. 10, PF2236. 11–12. *T. angulistriatus* comb. nov. 11, PF2245. 12, PF2247.

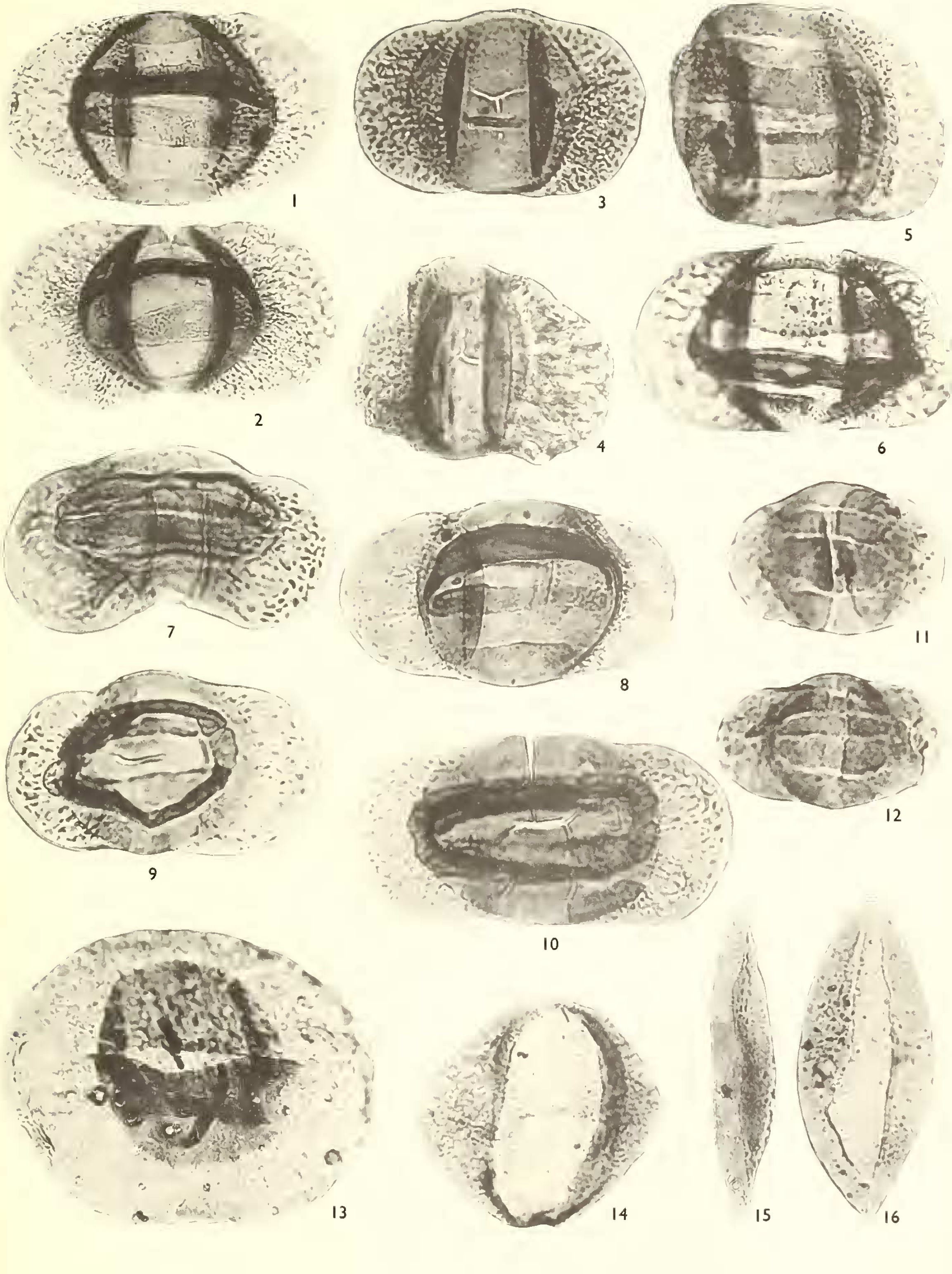
Figs. 3–4. *Illinites delasaucei* Grebe and Schweitzer. 3, PF2279. 4, PF2283.

Fig. 13. *Potonieisporites novicus* Bhardwaj, ×500, PF2203.

Fig. 14. *Labiisporites granulatus* Leschik, PF2270.

Figs. 15–16. *Cycadopites rarus* sp. nov. 15, PF2292. 16, Distal view of holotype, PF2293.

Localities of figs. 5, 11, 12, Hilton Plant Bed. Remainder, Lower Permian Marl, Kimberley.

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considered as such since this was the first species used in a valid combination, and the genus becomes valid from that date.

The type species is characterized by the possession of rudimentary sacci. Recently, however, there has been some difference of opinion concerning the limits of the genus. Wilson (1962, p. 24) emends the genus and while accepting *V. subsaccata* as the 'genotype' proposes (p. 25) that the genus be restricted to forms without sacci. Jansonius (1962) makes a similar proposal independently, arguing that the terminal structures, which may be considered as small sacci, might equally well be terminal extensions of the equatorial rim. *Vittatina* is used here for bilateral, multistriate pollen grains which may possess rudimentary sacci and where the distal (? germinal) furrow is at right angles to the proximal taeniae.

*Comparison. Vittatina* differs from *Protosacculina* emend. Jansonius 1962 in the sacci, where present, being smaller and from *Aumancisporites* emend. Jansonius 1962 in the absence of a transverse distal furrow with thickened margins. Alpern's original description of *Aumancisporites* made no mention of a distal furrow, but on re-examination of Alpern's material Jansonius (1962) emended *Aumancisporites* to include forms which, in other respects, were *Vittatina*-like, and which he considered to have a distal transverse furrow bordered by lips. I think this feature is probably a fold or buckle produced by squashing, and reject his emendation.

*Hamiapollenites* Wilson (February) 1962 (= *Hamipollenites* of Jansonius (April) 1962) differs from *Vittatina* in the larger size and different shape of the sacci. *Vittatina* differs from the type of pollen previously assigned to *Ephedripites* and *Welwitschiapites* primarily in the absence of a colpus or colpi disposed parallel to the striations.

*Vittatina hiltonensis* Chaloner and Clarke 1962

See Chaloner and Clarke 1962.

Infraturma DISACCITRILETI Leschik 1955

Genus ILLINITES (Kosanke) emend. Potonié and Kremp 1954

1963 *Limitisporites* Leschik emend. Schaarschmidt.
1963 *Jugasporites* Leschik emend. Klaus.
1963 *Limitisporites* Leschik; Klaus.

*Type species. I. unicus* Kosanke.

*Discussion.* The emendation of Potonié and Kremp (1954) emphasizes the inequality of the length of the arms of the tetrad scar, not evident from the original diagnosis of Kosanke (1950). In some Permian bisaccate miospores there exists a gradation from forms possessing a monolete mark (*Limitisporites* Leschik) through forms showing a 'roof-shaped' (= dachformig) split (*Jugasporites* Leschik) to spores possessing a triradiate mark, often with one arm developed to a greater or lesser extent than the other two (*Illinites* Kosanke). Such a gradation of the tetrad scar prompts Grebe (1957) to consider the roof-shaped split as a retrograde or vestigial Y-mark. Such an argument finds a good deal of support from the work of Potonié and Schweitzer (1960) in their study of the pollen of *Ullmannia frumentaria*. Grebe and Schweitzer (1962) accordingly include all the forms discussed above with variable arrangement of the tetrad scar in *Illinites* Kosanke emend. Potonié and Kremp, and this procedure is followed here (see also Klaus 1963, p. 270 footnote).

While it is certain that *Illinites* represents, at least in part, the pollen of *Ullmannia frumentaria* it cannot be assumed that this is the only source plant of *Illinites*, and other closely related or more distantly allied plants or plant groups may have produced spores with a similar variety of the tetrad scar.

*Illinites delasaucei* (Potonié and Klaus) Grebe and Schweitzer 1962

Plate 44, figs. 3–4

1963 *Limitisporites delasaucei* Schaarschmidt, pl. 11, figs. 14–17.
1963 *Jugasporites delasaucei* Leschik; Klaus, pl. 6, fig. 19.

*Remarks*. The present forms are well covered by the clear descriptions given by Potonié and Klaus (1954), Klaus (1955), Grebe (1957), Grebe and Schweitzer (1962), and Schaarschmidt (1963). Leschik (1956, p. 132) observes that certain of his specimens assigned to *J. delasaucei* have the sacci connected laterally by an exoexinal strip up to 9 $\mu$ wide. The British specimens show this feature to be not greater than 5 $\mu$ wide and in the majority of specimens such a feature is not seen.

*Illinites tectus* (Leschik 1956) comb. nov.

Plate 41, figs. 6–7; text-fig. 12

*Remarks*. This species shows a less variable tetrad scar than *I. delasaucei*, and further differs in the presence of two 'roughened areas' (thickenings) on either side of the tetrad scar (text-fig. 12).

*Illinites klausi* sp. nov.

Plate 40, fig. 12, Plate 43, fig. 14; text-fig. 13

*Holotype*. Plate 40, fig. 12. Slide PF2290. Sample K 14, Kimberley, Nottinghamshire; Upper Permian (Lower Permian Marl = Marl Slate).

*Diagnosis*. Spore body circular, bearing a small triradiate mark. Sacci small, offlap crescent shaped in polar view.

*Description*. The spore body is large and dark coloured with exine 2 $\mu$ thick. There exists on the proximal face a large triangular area where the exine is thin and within which is a Y-mark (text-fig. 13). The sacci are semicircular or less in outline and the offlap equals the overlap; the greatest width of a saccus, as seen in polar view, is measured along the distal attachment. The saccus infra-sculpture is a fine reticulum.

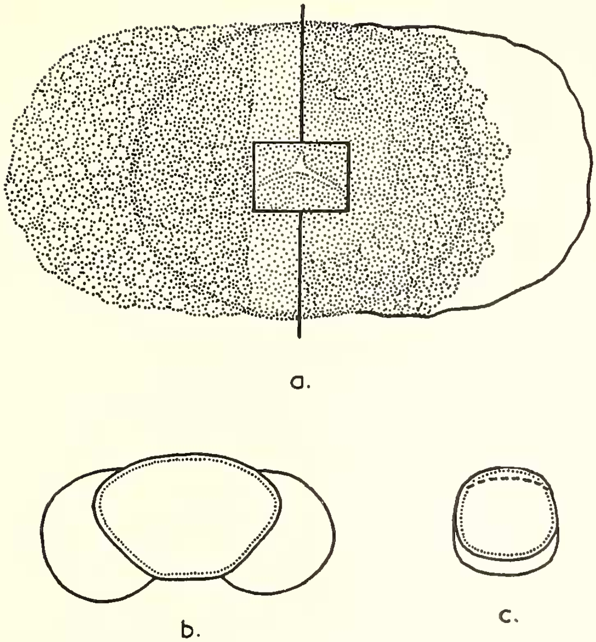
*Dimensions*. (Sixteen specimens.) Spore-body length 22(27)33 $\mu$, spore-body width 27(32)39 $\mu$, overall length 41(47)50 $\mu$.

*Comparison*. The present species differs from *I. parvus* Klaus 1963 in the structure of the proximal face of the spore body, and from other species of the genus in the shape of the saccus offlap.

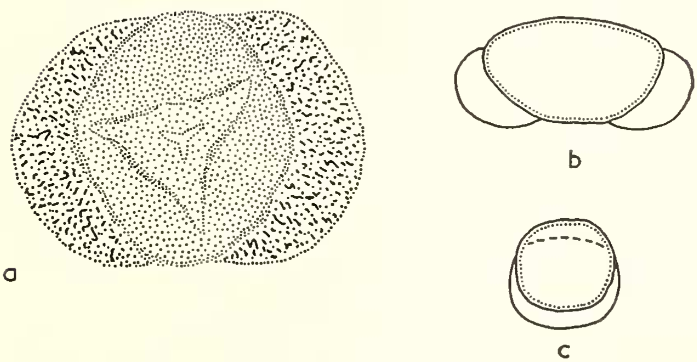
Infraturma DISACCIMONOLETES Klaus 1963
Genus LABIISPORITES Leschik emend. Klaus 1963

*Type species L. granulatus* Leschik 1956.

*Comparison*. *Labiisporites* differs from *Illinites* in the absence of a Y-mark and the




TEXT-FIG. 12. *Illinites tectus* comb. nov. *a*, Polar view showing proximal face, on the right, and distal face on the left (drawn from specimen), ×1,000. *b* and *c*, Diagrammatic reconstructions. *b*, Lateral polar section. *c*, Terminal polar section.



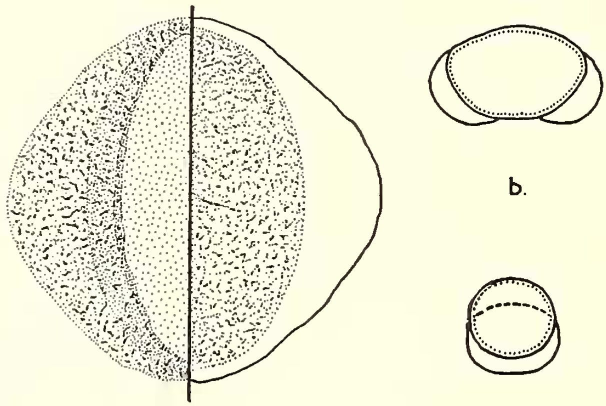

TEXT-FIG. 13. *Illinites klausi* sp. nov. *a*, Polar view of proximal face showing the small triradiate mark surrounded by a larger triangular area (based on holotype), ×1,000. *b* and *c*, Diagrammatic reconstructions. *b*, Lateral polar section. *c*, Terminal polar section.

presence of a distal sulcus. *Alisporites* emend. Nilsson 1958 differs from *Labiisporites* in having a distinct spore body, coarser saccus infra-reticulum and overall larger size.

### *Labiisporites granulatus* Leschik 1956

Plate 41, fig. 5, Plate 44, fig. 14; text-fig. 14

*Remarks.* This species constitutes a small percentage of the microfloral assemblage in most of the Permian samples studied. There is, however, less variation than observed by Klaus (1963).




TEXT-FIG. 14. *Labiisporites granulatus* Leschik. *a*, Polar view illustrating proximal face with an indistinct monolete mark, on the right, and the distal face on the left (drawn from specimen), ×1,000. *b* and *c*, Diagrammatic reconstructions. *b*, Lateral polar section. *c*, Terminal polar section.

### Infraturma DISACCIATRILETI (Leschik 1955) Potonié 1958
### Genus KLAUSIPOLLENITES Jansonius 1962

1963 *Falcisporites* Leschik emend. Schaarschmidt (pars).

*Type species. K.* (al. *Pityosporites*) *schaubergeri* Potonié and Klaus 1954.

*Discussion.* Manum's (1960) emendation of *Pityosporites* Seward 1914 excluded many species assigned to this genus by Potonié and Klaus (1954). His suggestion that these forms be included in *Jugasporites* Leschik 1956 found little favour and Jansonius (1962) erected the genus *Klausipollenites* to accommodate certain of these miospores excluded from *Pityosporites* by Manum's emendation.

Although *Klausipollenites* is bisaccate there are specimens, which on other grounds cannot be properly excluded from the genus, which show a more or less monosaccate condition. In this case it is difficult to separate the genus from *Vesicaspora* Schemel 1951 (see Jizba 1962).

*Comparison. Klausipollenites* differs from *Falcisporites* emend. Klaus 1963 in the elongated oval outline and the lack of a distal furrow and from *Alisporites* emend.